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THE SCIENTIFIC METHOD AND AUTHORITY[1]

But the mortellest enemy unto knowledge, and that which hath done the greatest execution unto truth, hath beene a peremptory adhesion unto *Authority*, and especially the establishing of our beliefs upon the dictates of Antiquites. For (as every capacity may observe) most men of Ages present, so supersticiously do look upon Ages past, that the *Authorities* of the one excel the reasons of the other.—*Sir Thomas Browne.*

One who is ignorant of the history of science is ignorant of the struggle by which mankind has passed from routine and caprice, from superstitious subjection to nature, from efforts to see it magically, to intellectual self-possession.—*John Dewey.*

Discussion stimulates while controversy depresses.
—*Dr. Florence Sabin.*

The Scientific method must ultimately spread out to every human affair.—*H. G. Wells.*

A religion of authority gives rise to a scholastic theology; by the same necessity the religion of the spirit seeks to find form and expression in a theology which is increasingly scientific.—*Auguste Sabatier.*

Prove all things; hold fast that which is good.
—*St. Paul.*

In every true searcher of nature there is a kind of religious reverence.—*Einstein.*

For who would keep an ancient form
Thro' which the spirit breathes no more?
—*Tennyson.*

THE struggle between that spirit in man which urges him to seek an explanation of things as they are and that spirit which prefers to rest upon the slumber-wooing bosom of tradition has been the theme of many learned treatises and of innumerable disputations.

To Dr. John W. Draper it seemed best described as a conflict between science and religion.

When Andrew D. White came to tell the story of the actions and reactions between the desire to know and the will to believe he gave to the world his admirable "History of the Warfare between Science and Theology."

[1] Address of the retiring vice-president of Section F—Zoology—American Association for the Advancement of Science—given at Kansas City, December 29, 1925.

In its present-day development it has assumed an aspect in which the line of cleavage does not, if it ever did, run between science and religion, neither does it divide one science from another; although some religionists confuse the issue, and, for the moment create the belief in some minds that there is an irrepressible conflict between science and religion. The real line of cleavage, however, is that which separates those who arrive at truth by way of the scientific method from those who frame their beliefs in accordance with some traditional authority.

THE SCIENTIFIC METHOD

It would be unnecessary, if I had in mind no other audience than the zoologists present, to define the term scientific method.

When reduced to its simplest expression it is no more than those processes which every normal person employs, whereby, through observation, experimental tests, and comparison with knowledge already possessed, he arrives at a reasoned conclusion.

An example of the employment of the scientific method, while it may seem trivial, since it is drawn from the experiences of a boy who, at the time he first used it, probably never had heard of the word science, will serve my purpose rather better than one which might call for the use of technical terms.

On a morning following a night during the latter part of which there has been a fall of snow, a boy, out hunting, notices certain marks in the snow which, instead of being haphazard, as are other marks which he sees have been made by small masses of snow which are falling from the branches of the trees as they are swayed by the wind, are in quite orderly arrangement. They are in groups of four, much as he could make by pressing two of his fingers, held some two or three inches apart and nearly side by side, and two other impressions made in the same way but one in front of the other and some eight or ten inches from the pair of parallel marks. Moreover, a line joining the paired impressions is nearly at right angles to the line which joins the other two.

He observes that these groups follow one after the other, a few feet apart, and form an unbroken line which stretches between a patch of blackberry briars and a brush-heap. His discerning eye notes that the two parallel impressions are consistently at that end of the group which points towards the brush-heap. So much for his observation of facts. Next follows what might be called an experimental test, at least a search for additional facts. Keeping at some distance from the brush-heap, he walks around it, meanwhile carefully examining the snow. Suppose that he finds the snow which surrounds the brush-heap free from orderly placed markings other than the one line of impressions which connects it with the briar-patch. His acquaintance with such signs as these teaches him that a short time before a rabbit left the briars and hopped in the direction of the brush-heap. His investigation of the available facts thus far, since in the language of the fable, there are no returning footprints, justifies his very reasonable hypothesis that there is a rabbit in that brush-heap. Imagine that boy's disgust if some traditionalist passer-by should object to the validity of his reasoned conclusion, call it impious and inform him that these marks were placed there by the creator of the snow or else were freaks of nature.

This would be no more an affront to reason than much which stands written against the rational interpretation of fossil footprints. Even in this year 1925 a book has appeared, "The Dogma of Evolution," in which (p. 155) is printed this criticism of paleontological conclusions: "The positive evidence of so momentous a change of structure (appearance of Amphibia) to be derived from six footprints seems a slender one on which to base the continuity of evolution." Which naturally makes one wonder whether eight footprints would be convincing, or if there had been but four, whether they could be admitted as evidence at all.

Of course our hunter may be quite ready to admit that, while the evidence at hand points to the conclusion that there is a rabbit in the brush-heap, further investigation may show that there is no rabbit there. For example, a hawk may have swooped down and carried it off through the trackless air, but if that were the case there would be some evidence that such a tragedy had been enacted.

Some thirty years ago, more or less, towards the close of the day, I unpacked a lot of material which had been collected by the Rev. W. E. Johnston, missionary to West Africa. Among much other interesting and valuable material were the skull, the bones of a hand, and the skin of a hand of a large male gorilla. This material I had left lying on a table in my room in the college. When I entered this room on the following morning, I found the janitor, John Washington, so deeply engrossed in an investigation in comparative anatomy that he did not reply to my morning greeting. He was holding the little finger of the gorilla beside the corresponding finger of his own hand. The nails on the fifth digits of these representatives of two genera of primates, *Troglodytes gorilla* and *Homo sapiens*, var. *Africanus*, thus laid side by side, were practically identical in shape, color, and differed not greatly in size. Instead of answering me in his usually polite manner, he said: "What is this?" I told him that it was the hand of a gorilla. His next question, and there

was in it a tone of mingled awe and reasoned conclusion, was: "Are they like us?"

Indeed the scientific method is simply the natural reaction of man to his surroundings when not hampered by the taboo of traditional authority. His method of arriving at truth is in no way changed when he is assisted by instruments of precision, or by devices which increase the range of his sense organs.

If those zealous people who have appropriated, without what seems to be an appealing justification, the name Fundamentalist would consult their own common sense, and apply the scientific method to an examination of the anti-science tenets of their theology, they might be led to remove a lot of the hay and stubble which has got into their foundations. Reason is a talent entrusted to man, and the failure to use it aright brings its own appropriate penalty. If after rejecting the rubbish they build into their religious foundations those experiences which Fosdick happily terms reproducible, they may themselves become guides to a religion the abiding truth of which they would demonstrate by their own manner of life.

AUTHORITY

The word authority is employed in two quite different ways.

(1) There is a common use of the word of which there is no possibility of a misunderstanding, although there may be inaccuracy in its application in given cases.

When we speak of T. C. Chamberlin as an authority in dynamic geology, of H. S. Jennings as an authority in biology, of Robert A. Millikan as an authority in molecular physics, of Henry Fairchild Osborn as an authority in vertebrate paleontology, we are speaking of savants whose wide experience and expert knowledge in their several fields of research are recognized by their fellow-workers in those fields, and we are making a proper use of the word.

It should be noted that no one, least of all any one of the persons thus designated as an authority, would ever dream of ascribing anything approaching infallibility to his opinions. Obviously it is a matter of considerable moment that the one who is cited as an authority should be recognized as such by those who are qualified to judge.

In my reading of the past few months I have gone through a fairly representative collection of anti-evolution books and pamphlets, and note that, like the anti-vaccinationists, and anti-animal-experimentalists, the writers of this eccentric literature have an unerring instinct which leads them to quote as authorities persons who are unknown to specialists in the subjects concerned or, if indubitable authorities are quoted, the extracts selected belong to a time when knowledge of the subject had not advanced to its present stage. They quote authorities to win decisions or to capture votes, not to establish truth. If these people were as reckless in their choice of a surgeon or architect or mechanic as they are in the matter of attributing authority to a mountebank whose chief recommendation is a certain skill in handling piously sounding phrases, it is reasonably certain that the most fundamental of them would soon be taught a practical lesson in truthfulness which he would lay to heart.

(2) Another use of the word authority is one liable to be misunderstood, because of its popular confusion with the ideas of infallibility and inspiration. Perhaps the term traditional authority will best describe this use of the word. And here, as I am brought to the border of a province but little traversed by biologists, I shall quote from a theological writer who, to the best of my knowledge, is worthy of attention:

> The notion of authority and inspiration have reacted inextricably upon each other: they can hardly in their relations to Christianity be studied apart: and both have been injuriously affected by that spirit of legalism, begotten ultimately of the Roman imperial system, from the cramped tyranny of which in one form or another the whole of Christendom still suffers.
>
> Here it may be sufficient to remark that we have no more reason *a priori*, to look for infallibility in the sphere of intelligence, as the result of the operation of the Divine Spirit which we call inspiration, than we have to look for impeccability in the sphere of conduct, as the result of that parallel operation of the same Spirit which we call grace.
>
> There is a sense, indeed, in which the so-called orthodox Protestantism which for three hundred years dominated Northern Europe and in which our fathers for the most part believed, was not Protestantism at all, but only mutilated Catholicism. Its intellectual basis, that is to say, was equally authoritarian with that of Rome, from which it differed merely in the substitution of the infallible Book for the infallible Church: a substitution which in itself was by no means an improvement.
>
> Such, it is only fair to say, had not been the position of the original Reformers. Luther, for instance, found the seat of authority not in the letter of the Bible but in the self-authenticating witness of the spirit of God speaking through its pages and discerned by the spiritual man: he proceeded on this basis to exalt such of the Bible books as particularly appealed to him and to depreciate others. . . . Historically Protestantism as a whole lost sight of it and fell back upon infallibility and verbal inspiration.[2]

[2] "Foundations, Christian Belief in Terms of Modern Thought," pp. 368, 372; "The Principle of Authority," A. E. J. Rawlinson, Keble College, Oxford.

. . . Both infallibilities, we may say, are to-day discarded; the infallible book has gone the way of the infallible Church.

These quotations enable us to understand something of the historical development of the idea of an infallible authority.

The topic which I have chosen for discussion, it is to be observed, is "The Scientific Method *and* Authority," not "The Scientific Method *or* Authority." Authority, even if it be of the traditional kind, is not necessarily erroneous, and with authority which is true science can never come into conflict.

It can not be stated too emphatically, however, that for an authority which is not ready and willing to reexamine its foundations in the light of advancing knowledge, science can have but little regard.

ANTI-SCIENCE TO-DAY

Five years ago no one would have thought of discussing a semi-theological topic before Section F.

To one taking a superficial view of science in this country it might appear that Bateson's fateful speech at Toronto four years ago was the Sarajevo shot which precipitated war. However that may be, the scientific population, being of peaceful habits, were at first not disturbed by the noise and the shoutings. They are not much disturbed yet. They may be a contemptible little army politically in the eyes of the anti-science swashbucklers, but they are confident in the righteousness of their cause and unafraid. Their weapons are those with which science has aforetime battled, the discovery of new knowledge and demonstration of the truth. Science has won her way to her present position of dominance in the world's thought along the peaceful and pleasant paths of wisdom and knowledge. Entrenched authority from time to time, as new knowledge appeared to threaten vested interests or ancient beliefs, has resorted to opposition, oppression, persecution, hangings, burnings, torturings in ways of unbelievable cruelty. Until the Dayton, Tennessee, tragicomedy of last summer the land had enjoyed peace from outbreaks of religious violence since the epidemic of witchcraft hysteria in Massachusetts near the close of the seventeenth century. The total number of victims of the literalism of that unhappy time, we are told, were nineteen human beings hanged, one pressed to death for refusing to plead, according to the old criminal law practice: two dogs, accused of witchcraft, were also put to death.[3]

Bad as it was, this was trifling compared with the vast numbers put to death in Europe on the charge of witchcraft. Thus, speaking of Germany from the middle of the sixteenth to the middle of the seventeenth century, White says: "An eminent authority on this subject estimates the number of victims thus sacrified during that century in Germany alone at over a hundred thousand."[4]

It is significant that just as the witchcraft superstition was dying out in Europe there was a temporary flare-up of the same in this country so, in this twentieth century, with evolution accepted in Europe after an intellectual conflict, ended more than a generation ago, there is a backfire of anti-scientific frenzy among the ill-informed, scientifically, and the badly instructed, religiously, of portions of this country.

That the old spirit of persecution has not died out may be read in a typical emotional outburst, quoted by Charles T. Sprading.[5] One of those gentle well-wishers of humanity is thus reported:

> Take the evolutionists, infidels and no-hell teachers out somewhere and crucify them, head downwards, and we will have a better country to live in and, instead of these evolution and easy-way ideas, teach people the Word of God to go by, and all will be well.

This has all the marks of a hasty and ill-considered proposition. A better plan would seem to be, first to teach the people the word of God to go by, and then all will be well, and it will not be necessary to crucify anybody, head downwards or otherwise.

This twentieth-century echoer of the old mob cry, "Crucify him, Crucify him!" would do well to heed the words of a student of authority:

> Summing up, we may lay it down as the function of authority in religion neither to compel assent nor to override reason, but to testify to spiritual experience.[6]

And here I may be permitted to remark that it was not until I had given considerable time to the study of the situation that I came to the conclusion that the apparent distrust of science noted by students of present-day tendencies, and the ill-informed criticism of the theory of the origin of species by descent with modification, are but incidental to a larger conflict of ideas, *viz.*, that between the so-called Modernists and the self-styled Fundamentalists.

The situation, therefore, resolves itself into the inevitable conflict between the scientific method of arriving at reasoned conclusions, and reliance upon an authority to which the attribute of infallibility is imputed.

When it is taken into consideration that there is

[3] "Wonders of the Invisible World," Cotton Mather. Volume printed in London by John Russel Smith, 1862, p. viii.

[4] "Warfare of Science," II, p. 75.

[5] "Science *versus* Dogma," p. 119.

[6] Rawlinson, *l. c.*, p. 380.

practical unanimity of opinion among scientific investigators, not only in the strictly biological sciences, including all sciences relating to man, such as anthropology, ethnology, philology, and the like, but also the sciences of astronomy and geology, to go no farther, as to the truth which the application of the scientific method to their several departments of research reveals in accounting for things as they are, then it becomes apparent that the agitation against the teaching of a reasonable explanation of natural processes, to which the name evolution is given, is at bottom an emotional as distinguished from an intellectual movement.

The word "religious" is not the proper one to use in such connection, for religion that is pure and undefiled is separate from the anti-evolutionists, and, in view of the fact that theologians of the present day are far from being hostile to evolution, one is barred from characterizing the movement as a theological one.

It may be that others beside myself, absorbed as we have been in the cultivation of physical science, have not thought of theology as a science. This must be my excuse for devoting a short time to this question, and, incidentally, to make amends for the injustice which I have unintentionally done to a noble company of seekers for the truth, by thinking of theologians as being either indifferent or actually hostile to science.

There have been notable examples of theologians who have assented readily to the conclusions of scientific workers, as there have been men of science who have yielded but slowly. The accord between theology and the physical sciences has been growing closer since the universal acceptance, after years of opposition, of that interpretation of the cosmos, including organic beings, which goes by the name of evolution. And I have yet to hear of any hostility on the part of theologians to the revelations which the science of physics is making to the world. The only thing in the way of ill-natured criticism of sub-atomic physics which I have seen is in that exasperating book, "Dogma of Evolution," written by a physicist, where the author says: "Our debauch of evolution, of aethers and of electrons is fast carrying us back into the state of medieval absurdities."[7] My feeling of gratification that I am here doing the theologians a good turn is somewhat chilled by the suspicion that the author of "Dogma of Evolution" is something of a dilettante theologian as well as a professional physicist.

My friend, Dr. James H. Snowden, has kindly let me read the manuscript of a paper, "Teaching Theology in an Age of Change," which he presented at the Theological Seminary Conference at Grand Rapids, May 21, 1924. From which I take the liberty of quoting as follows:

> Last came evolution and again the theologians made a loud outcry as though the heavens of religious truth were passing away with a great noise. There has recently been a recrudescence of this disturbance, and some good people are alarmed, but the problem has been well worked out into adjustment and is generally accepted even in theological seminaries. When the Professor of Apologetics in Princeton Seminary publishes a paper in which he says: "The doctrine of evolution is taught in this institution as one of the ways of God's working," we may conclude that the truth on this belief has been seen and said even in the schools of theology.

It may be that some of us who have a low expectancy of years to come may live to see the day when there will be an exchange of professors of theology between, say Princeton and Union Seminary, New York. When that day comes who can question the claim of theology, in Sabatier's fine phrase, to "a place in the consecrated choir of modern sciences?" [7a]

In passing it may not be inappropriate to advert to the title "Queen of the Sciences," which one sometimes sees given to philosophy and sometimes to theology. As a graceful title, stripped of every attribute of royalty or power, there may be no objection to such designation. At any rate those of us who contribute to the music of the choir in a humble way (for even of parasitologists it may be said, They also serve who study only worms) may take comfort in the thought that there are queens and queens of infinite variety of temperament, from the Queen of Hearts, of Alice's Wonderland adventures, who shouted, in real Fundamentalist fashion, "Off with his head!" at the slightest provocation, to the amiable White Queen, who was so proud of her ability to spell words of one letter.

Although I am convinced that this wave of anti-science which is sweeping over parts of our country is essentially an emotional movement, the situation is rendered somewhat difficult to analyze on account of the diversity of the forms of attack on scientific activities. In fact the movement has opened a veritable cave of Adullam, from which primitive abode issue emotional exhorters for tradition against knowledge; vested interests whose traffic of iniquity is threatened by scientifically framed pure food laws; vendors of quack medicines and practicers of magic, who hate that science whose light is as deadly to them as is the light of the sun to anaerobic bacteria. Thence also issue many bizarre cults of pseudo-science, or mutilated science, wearing names borrowed

[7] P. 111.

[7a] "Religions of Authority," p. 345.

from the language of medical knowledge, such as chiropractic, osteopathy, Christian Science, and the like, not evil in themselves, but certain to do harm when employed in cases where a regard for the demonstrated truths of science would forbid their entrance.

In this motley anti-science mob also appear such anti-social eccentrics as anti-vaccinationists, anti-animal-experimentalists, and the like ilk. Each and every of this pernicious horde can be definitely and effectually disposed of by the irrefragable logic of scientifically tested fact. I shall take time to deal with but one case, and that but briefly, *viz.*, that of the opposition to vaccination against smallpox.

Here is a convincing example of the efficacy of preventive measures against that highly contagious disease:

> In the Philippines prior to the occupation by the American Army, more than 40,000 smallpox deaths occurred every year in the Islands, and 6,000 deaths occurred annually in Manila. Vaccination was introduced by the Americans and smallpox diminished in the Islands. In 1903 there were 18,989 smallpox deaths and this number decreased year by year to a minimum of 239 in the year 1916. By that time the effect of the vaccination performed during the early years of American occupation had worn off and vaccination had been practically abandoned by the local officials. The neglect of this law enforcement led to a tremendous epidemic in 1918–19, resulting in 60,447 deaths.
>
> During the epidemic of 1918–19 our troops stationed in the Philippines were in constant contact with the native population, carrying aid to the stricken natives. They were surrounded by thousands of cases of one of the most contagious diseases known to man. Only one case developed among our 5,442 vaccinated troops.
>
> During the year 1923 there was an intensive campaign to vaccinate and, according to the annual report of the Philippine Islands, 2,132,653 individuals were vaccinated out of a total estimated population of 11,000,000. There were but four deaths from smallpox in the Islands that year.[8]

Such facts as these, taken from the recent history of the Philippine Islands, are corroborated by similar experiences in every country where compulsory vaccination has been introduced.

One would think that such evidence would convince every reasoning person of the folly and harm of opposing vaccination, and I think that where the evidence is properly presented, it does carry conviction. There will always remain a certain percentage of humanity who will be unconvinced, because unconvincible. These are the abnormal, if we are to regard man as being normally a reasoning being, persons of fixed ideas, among whom must be placed, temporarily at least, those who are enthralled by the fixed idea that their will to believe is warranted by their interpretation of an authority which they do not admit to be itself subject to scientific examination.

What is to be done to save our civilization from this threatened backset to medievalism? An appeal to that worthy body of our citizens who are to be found in the organized churches is sufficient, in ordinary cases, to enlist a powerful force against any evil. But here right and truth are wounded in the house of those who should be their friends. This return to unguided literalism, under the name of Fundamentalism, is something in the nature of an emotional cyclonic area of low intellectual pressure which is passing over the churches and generating, as it progresses, a crop of local, sub-theological twisters, and vocal vortices which are doing much damage to the reputation for truthful and temperate statement and for ordinary fair dealing, except where covered by the cloak of a feeble understanding, of many who imagine that they are the called of the Lord against the mighty.

Of course, if these for the most part well-meaning people, who are suffering from this epidemic of traditionitis and have not immunized themselves against superstition by putting on the armor of common sense, would listen to their own educated teachers in the theological schools, no alarm need be felt. Sound scholarship, based as it is on a rigorous application of the scientific method, can be trusted to get at the truth in all departments of inquiry. Even the turbulent emotions of this mob which has turned against its qualified leaders, to follow for the moment frantics more emotional, and no better informed than itself, is a proper subject for study. It is a good time now for some student of mob psychology to give a proper diagnosis of this particular emotionalism which has taken the form of fear and hatred of a creature of its own imagination, which it calls evolution, and prescribe the proper treatment.

It might be worth while to ask those agitators who are attacking scientific investigators to appoint a committee that shall accompany a number of trained workers in the public health service in making a survey of various localities where scientifically directed public health work has been allowed to be carried on unopposed for a series of years, and has been given as generous support as has been afforded to the organized church work in the same localities. Also the joint committee shall make a survey of localities where public health work has not yet been inaugurated, but where Christian churches have ex-

[8] "Smallpox, a Preventable Disease," American Association for Medical Progress, pp. 16–17.

isted for long enough time to allow of a study of their work.

If such surveys do not show that the people in those communities who have heeded the gospel of science, who have been instructed as to the causes and prevention of such debilitating parasitic diseases as hookworm and malaria, of such devastating scourges as typhoid, diphtheria and smallpox, of such dread calamity as rabies, are happier, more prosperous and better disposed to help their fellow men: if they are not more earnest and efficient in the promotion of righteousness and true religion than are those who have enjoyed only the benefits that come from the organized church, which no unprejudiced person denies, then we may begin to think that after all this world may not be what science teaches us that it is.

We may then be ready to go back to the days when humanity was passive under the visitation of pestilence and plague, reading in them punishments inflicted by an angry god or gods, for neglecting to offer sacrifices of the proper odor; to those bad times when demons lurked beside the way, and witches wrought their nightly deeds of evil; to that dread age when men cowered in terror at the appearance of a comet in the sky, interpreting it to be a fiery messenger from an angry and jealous potentate above the firmament, who at any time might open gigantic flood-gates in the dome above our heads and bring another Sinflood upon mankind.

ANTI-SCIENCE LEGISLATION

That the emotional anti-science elements in society are still running true to form in this twentieth century is shown by organized efforts to control, limit or prohibit scientific instruction in our schools by legislation.

A brief review of some of this legislation which has been enacted or proposed will be instructive.

Section I, of the Tennessee anti-science law (March, 1925), reads as follows:

> Be it enacted by the General Assembly of the State of Tennessee, That it shall be unlawful for any teacher in any of the universities, normals, and all other public schools of the State which are supported in whole or in part by the public school funds of the State, to teach any theory that denies the story of the Divine Creation of man as taught in the Bible, and to teach instead that man descended from a lower order of animals.

A joint resolution of the House of Representatives, and Senate, in 1923, of the Florida legislature is of similar purport.

> Be it resolved by the House of Representatives, the Senate concurring: That it is the sense of the legislature of the State of Florida that it is improper and subversive of the best interest of the people of this State for any professor, teacher or instructor in the public schools of this State, supported in whole or in part by public taxation, to teach, or permit to be taught atheism, or agnosticism, or to teach as true Darwinism, or any hypothesis that links man in blood relationship to any other form of life.

A similar bill, in 1921, was defeated in the Kentucky legislature by a vote of 42 to 41. In 1921 a rider attached to the general appropriation bill by the Senate of South Carolina provided that:

> No moneys appropriated for public education or for the maintenance or support of State-supported institutions shall be used or paid to any such school or institution teaching, or permitting to be taught, as a creed to be followed, the cult known as Darwinism.

Senator Miller, who introduced the proviso, explained that it applied only to "Darwinism" and not to such theories of evolution as are advocated by Lamarck, Bergson, Osborn and others. The amendment passed the Senate but was stricken out of the bill by the joint committee.

Plainly, Senator Miller is something of a joker and deserves the thanks of all those who are acquainted with the work and writings of the worthies named by him for thus injecting into the current of anti-science literature this joyous elixir.

The teaching of evolution in the public schools of the states of Oklahoma and Texas has also been prohibited by law.

The last Congress attached a rider to the appropriation bill prohibiting the teaching of anything implying disrespect to the Bible in the schools of the District of Columbia; and I am informed that the Fundamentalists, having obtained a majority in Congress, have had prepared a very strict anti-evolution bill for introduction into the new Congress which will prohibit the teaching of anything of the sort at Annapolis, West Point or in the schools of the District of Columbia.

Such laws reflect the spirit which was dominant in the direction of public education in Prussia before the World War, of which it has been said: "The avowed purpose of the schools in Prussia was not for the spread of the truth but for the war against social democracy."[9]

A more ominous portent is that which is reported in the Springfield, Kentucky, *Sun* for February 14, 1924. At a meeting of the citizens and patrons of the schools the following resolution was passed:

> That the teaching of biology or any kindred subject is objectionable to a large majority of the patrons of the school; and whereas we have found from experience that the subject of biology so readily lends itself to the teach-

[9] Graham Wallar, "The Great Society," p. 153.

ing of evolution, we ask that it be eliminated from the curriculum of said school and some other subject taught instead.

The use which anti-science lawmakers in this country at the present day would make of our schools would seem to be, not as training grounds for the development of leaders in the discovery of new knowledge, but rostra for the training of declaimers against all knowledge that is not in accord with traditional beliefs.

EDWIN LINTON

MEDICAL DEPARTMENT,
UNIVERSITY OF GEORGIA

(To be concluded)

PLATFORM OF THE ENGINEERING FOUNDATION

WHEN, in 1914, Ambrose Swasey, honorary member of the American Societies of Civil and Mechanical Engineers, proposed an Engineering Foundation to aid engineering research and made a generous gift as a "nest-egg" for its endowment, he put up to the national societies of civil, mining and metallurgical, mechanical, and electrical engineers a problem of more than passing interest and difficulty. It was the problem of organized engineering research under the auspices of these societies. Sooner or later, through one channel or another, this problem must have come before them, but theretofore it had not received their formal consideration.

Even in that advanced year of grace, very few engineers outside the electrical branch of the profession, had much understanding of research as conceived by scientists. The world war soon after Mr. Swasey's gift diverted effort to special services. "Reconstruction," with its peculiar problems, followed and other complications arose. Consequently, it was not until ten years after Mr. Swasey first made his proposal that attention was concentrated upon the main question of determining what the functions of an Engineering Foundation could best be as a joint instrumentality of the four societies just named and frequently designated as the Founder Societies.

Among questions demanding answer were the following:

1. Should Engineering Foundation directly organize and conduct research?
2. Should Engineering Foundation only support researches conducted by its Founder Societies, other organizations and individuals?
3. What relations should Engineering Foundation sustain to its Founder Societies, to other technical and scientific societies, to research organizations, to governmental departments, to industries, to educational institutions and to individuals?
4. With small income how could Engineering Foundation do most to promote and accomplish research in its field?
5. How could researches be increased directly or indirectly?

Naturally there were varieties of opinion on all sides. While discussion of these questions was going on, work was proceeding. Various elements of solutions of the problem were being tried out practically and many useful results were being achieved. Increments to the endowment have been received. Supplementing its direct income, Engineering Foundation during recent years has helped to bring about an average yearly expenditure of approximately one hundred thousand dollars for projects in which it has participated.

About a year ago, Engineering Foundation, as a step toward an acceptable solution of its organizational problems, formally requested of the boards of its Founder Societies a new expression of views on fundamental policies. Finally, in the fall of 1925, at the suggestion of the new chairman, L. B. Stillwell, out of accumulated experience and opinion, and from among many tentative formulations of policy and practise, drafted in preceding years, an answer appeared. A platform was unanimously accepted by the Founder Societies and was adopted by Engineering Foundation December 10. It follows:

Desiring to promote active and wisely directed research as a means to scientific and technical progress and believing that systematic cooperation by Engineering Foundation and the several Founder Societies is essential to any development of the research work of the societies commensurate with the dignity, influence and resources of the profession, Engineering Foundation, while reserving entire liberty of action under the authority conferred upon it by the Founder Societies, through United Engineering Society, adopts the following declaration of its present plan and policy:

1. Engineering Foundation regards engineering research as the preferred field for its activities.
2. It will select or approve specific researches which it will assist by appropriation of funds or otherwise.
3. It will select for each project the agency, collective or individual, which it deems most effective.
4. It will assume no direct responsibility for the prosecution of any specific research.
5. It will cooperate with the national Engineering Societies and preferably support researches approved by it sponsored by one or more of them.
6. A member of Engineering Foundation, or of its staff, may be an advisory, but not an active, member of any committee or other organization in immediate charge of a research assisted financially by the

Foundation. This provision will not be retroactive.

7. Engineering Foundation reserves the right to require from committees or other organizations or individuals assisted, satisfactory progress reports as a condition of continued support.
8. Engineering Foundation will cooperate with the several founder or other national engineering societies in raising funds for the prosecution of approved researches.
9. It will endeavor to prevent conflict or overlap of research effort among the agencies which it supports or assists.
10. It will cooperate in securing information of the state of the art for use of committees of the Founder Societies or other agencies.

By adopting this platform Engineering Foundation believes it has forestalled queries which might arise as to whether its acts were always impartial and judicial in the allotment of funds. A double safeguard is thrown around the funds put at its disposal. The interest of the Founder Societies and their research committees will be quickened.

Engineering Foundation is entering its second decade, therefore, with increased assurance of support, with brighter prospects of greater resources, with greater faith in the purposes for which it was created, and with higher appreciation of the foresight of its founder. With much confidence it now looks to those who profit from the work of the engineering profession (and who does not?) to make its funds sufficient to do more nearly the volume of services expected of it "for the furtherance of research in science and in engineering, or for the advancement in any other manner of the profession of engineering and the good of mankind."

ALFRED D. FLINN,
Director.

ENGINEERING FOUNDATION

THOMAS ALLISON SMITH[1]

WE have met to unveil a memorial to one who for twenty-seven years was a loyal and devoted servant to Bellevue Hospital. It is fitting that service such as was rendered by Dr. Smith to this institution should be recorded on a tablet of bronze, exposed to the public gaze, which shall carry its message of inspiration, let us hope, far down into posterity.

Deeds of men whose lives have been well spent continue to live and exert their influence, after the eyes of their enactors are forever closed and their lips speak no more.

Monuments to commemorate worth are like a continuous expression of "glad tidings and good will toward men," in a world in which the highest good of mankind is attained through the consistent practice of usefulness and the exercise of a kindly spirit.

[The tablet, adorned with fresh gladiolas, was then unveiled, the inscription on which was the following:

IN AFFECTIONATE REMEMBRANCE
OF
THOMAS ALLISON SMITH, M.D.
1872—1924
FOURTH SURGICAL DIVISION OF BELLEVUE HOSPITAL
1895 — INTERNE — 1897
1899—ASSISTANT-VISITING AND VISITING SURGEON—1924

THIS TABLET IS ERECTED BY THE VISITING STAFF OF HIS DIVISION, TO WHOM HE HAD ENDEARED HIMSELF BY HIS DEVOTION TO THE DIVISION AND HIS SPIRIT OF JUSTICE IN THE MANAGEMENT OF ITS AFFAIRS, AND BY MANY OTHERS AT BELLEVUE HOSPITAL WHO APPRECIATE HIS FAITHFUL AND EFFICIENT SERVICE OF TWENTY SEVEN YEARS, INCLUDING THE VISITING STAFFS OF THE FOURTH MEDICAL DIVISION AND THE FIRST, SECOND AND THIRD SURGICAL DIVISIONS, THE EXECUTIVE COMMITTEE OF THE MEDICAL BOARD, INTERNES AND MEMBERS OF THE TRAINING SCHOOL FOR NURSES.

A STAUNCH FRIEND OF HUMANITY, A DEVOTEE TO DUTY, AN ABLE SURGEON AND EXECUTIVE AND A MAN OF KINDLY PRESENCE.]

I would have you note on this tablet the gladiolas in relief, crossed above the inscription. They are a token of the pastime of Dr. Smith, whose delight it was to personally cultivate a great abundance of these beautifully colored flowers at his country home in Stamford, and bring them on summer mornings to the hospital wards, to gladden and to cheer the lives of the sick.

This tablet is erected by appreciative friends to perpetuate in Bellevue Hospital the memory of Dr. Thomas Allison Smith.

Thomas Allison Smith, a man who took an active part in helping to bring Bellevue Hospital up to its present state of high efficiency.

Thomas Allison Smith, a man who grew up under the influence of the "old school," having spent his earlier years in close friendship with his father, Brigadier-General Andrew Kingsbury Smith, an army surgeon of distinction.

Thomas Allison Smith, a rigid disciplinarian, but with it all a gentleman who enforced the right and truth with simple justice, without rancor. His denunciations were never spoken without justification. His views on discipline must have been influenced by his father's army training, as well as his own training for three years as a cadet at West Point, before he took up the study of medicine.

His relations with the visiting staff of his division are indicated in the words of the inscription: "The

[1] Address at the unveiling of the memorial tablet to Dr. Thomas Allison Smith, at Bellevue Hospital, January 13, 1926.

vsiting staff . . . to whom he had endeared himself by his devotion to the division, and his spirit of justice in the management of its affairs."

Outstanding characteristics are noted in the inscription below: "A staunch friend of humanity, a devotee to duty, an able surgeon and executive, and a man of kindly presence."

It is in such terms that we well recall to mind our former colleague, Tom Smith.

Tom Smith, a man whom children loved.

Let us say, our ever faithful friend, Tom Smith.

The fourth division now takes pleasure in tendering this memorial tablet into the keeping of the trustees of Bellevue Hospital.

WILLIAM C. LUSK

NEW YORK, N. Y.

SCIENTIFIC EVENTS

THE INTERNATIONAL CONGRESS OF PLANT SCIENCES

INVESTIGATORS and teachers in the plant sciences, representing all aspects of botany, plant chemistry, plant pathology and bacteriology, agronomy, horticulture and forestry, are invited to attend the International Congress of Plant Sciences (Fourth International Botanical Congress) to be held at Ithaca, August 16–23, 1926. This invitation is extended to all countries of the world. An announcement of the meeting was printed in SCIENCE for November 6, 1925.

This congress is scheduled to follow the usual academic sessions abroad, also the short summer session of the various universities and colleges in the United States. It is believed to offer the first opportunity ever arranged in the United States for a general conference of all those professionally engaged in plant work. It possesses the additional compelling interest accruing from unrestricted international representation.

In order that a part of the program may be representative of outstanding leadership, the congress will be divided into about one dozen sections, each section with an invitation program occupying about four morning sessions or a little more than one fourth of the available time. These formal programs will be supplemented by another feature that promises also to be of exceptional interest. Ample time will be set apart for round table or informal discussions, which in some cases may be scheduled in advance, and in others may be arranged both as to topics and participation after the congress actually convenes. This is intended to provide for the widest participation in sectional activities. Supplementary opportunities for individual contact and participation are made possible through the non-commercial exhibits and through the provision for excursions and inspection tours of various types suited to the diverse needs of the different sections.

Although the congress is not to provide an occasion for *legislation* on regulatory matters of international significance (such as nomenclatorial rules) the organizing committee has expressly provided that "adequate opportunity shall be accorded all sections for the *discussion* of regulatory recommendations of international significance," in order that a better understanding may be reached for definite action at a subsequent international congress.

The sections thus far authorized and the secretaries representing these groups is contained in SCIENCE for November 6. Communications regarding the congress should be addressed as indicated below:

(1) Concerning round tables and other strictly sectional matters—to the appropriate sectional secretary.

(2) Concerning exhibits and general program matters—L. W. Sharp, Cornell University, Ithaca, N. Y.

(3) Concerning excursions, collecting trips, inspection tours, local arrangements, transportation, etc.—H. H. Whetzel, Cornell University, Ithaca, N. Y.

(4) Concerning the congress in general.—B. M. Duggar, Missouri Botanical Garden, St. Louis, Mo.

THE ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS

THE Association of Asphalt Paving Technologists met on January 14, 1926, in the Hotel LaSalle, Chicago. The constitution and by-laws were adopted, officers were elected and committees were appointed. Forty members were present.

In January, 1924, a small group met in Chicago informally for the purpose of discussing such an organization. In January, 1925, a considerably larger group met in Chicago and definitely organized. Francis P. Smith, of Dow & Smith, consulting engineers, New York City, served as chairman of the first meeting. Hugh W. Skidmore, of the Chicago Paving Laboratory, Inc., Chicago, Illinois, was chairman of the 1925 meeting, and Chas. A. Mullen, of the Milton Hersey Co., Ltd., of Montreal, acted as secretary of both meetings. Roy M. Green, of the Western Laboratories, Lincoln, Nebraska, was chairman of the committee which drafted the constitution and by-laws.

The association will collect and distribute technical data pertaining to asphalt paving, encourage and conduct cooperative research work and will serve as a clearing house of ideas presented by its members. The officers for the present year are:

President: Hugh W. Skidmore, president, Chicago Paving Laboratory, Inc.

First Vice-president: Leroy M. Law, chief chemist, New Orleans Refining Co.

Second Vice-president: W. J. Emmons, highway research specialist, U. S. Bureau of Public Roads, Washington, D. C.

Secretary-treasurer: Chas. A. Mullen, director, paving department, Milton Hersey Co., Montreal.

Chairman Geenral Research Committee: Prevost Hubbard, chemical engineer, The Asphalt Association, New York.

Chairman, Committee on Voids in Aggregates: W. J. Emmons, U. S. Bureau of Public Roads.

Chairman, Committee on Street Operations: W. L. Hemplemann, engineer, The Texas Co., Chicago.

THE NATIONAL MUSEUM OF ENGINEERING AND INDUSTRY

IN accordance with an invitation, extended by the National Museum of Engineering and Industry to several societies many of whose members had joined it individually to nominate representatives to its board of trustees, the four National Engineering Societies, American Association for the Advancement of Science, American Chemical Society and the Society for the Promotion of Engineering Education have responded favorably and are now represented on its board, which is constituted as follows:

Mr. Samuel Insull, *Chairman*

Mr. L. P. Alford[3]	Mr. Frederick A. Halsey
Mr. B. C. Batcheller	Prof. Dugald C. Jackson[7]
Mr. Nicholas F. Brady	Mr. Luis Jackson
Mr. F. H. Colvin	Dr. F. B. Jewett[4]
Mr. Norman Dodge	Mr. John W. Lieb
Mr. Gano Dunn[4]	Mr. Fred R. Low[3]
Col. A. S. Dwight[2]	Mr. W. W. Macon
Mr. Thomas Ewing	Mr. L. C. Marburg
Mr. John R. Freeman[1]	Mr. H. P. Merriam
Col. Michael Friedsam	Dr. M. I. Pupin[5]
Major H. A. Gillis	Mr. W. L. Saunders[2]
Mr. Henry Goldmark	Mr. J. Waldo Smith[1]

Dr. Elmer A. Sperry[6]

[1] Nominated by American Society of Civil Engineers.
[2] Nominated by American Institute of Mining and Metallurgical Engineers.
[3] Nominated by American Society of Mechanical Engineers.
[4] Nominated by American Institute of Electrical Engineers.
[5] Nominated by American Association for the Advancement of Science.
[6] Nominated by American Chemical Society.
[7] Nominated by Society for the Promotion of Engineering Education.

Many of its members have donated to the National Museum original historical documents, old patent records, books, drawings, prints, models, photographs and descriptions of important work, etc., and correspondence regarding such things is solicited.

In this connection the secretary has, for some years, been collecting reminiscences not only by eminent men regarding some of their accomplishments which have not been previously recorded, but by others who may not have had such opportunities at all. There are undoubtedly many more still living or there may be some who have worked in cooperation with or in the service of others who have accomplished notable work or others who have had interesting associations with or interviews with men of notable achievements and all of these could supply very interesting reminiscences if given the opportunity.

For instance, recently a member of the American Society of Mechanical Engineers told of having called in 1889 on James Nasmyth, the inventor of the steam hammer and many other notable mechanisms, at his home in Kent and the latter recounted to him his experiences with James Watt who invented the steam engine in 1769. So the span of one man's life intervened between that of the man to whom more than to any one can be credited the wonderful development which has taken place in the world and that of his visitor and thus was obtained, only second-hand, a description of James Watt's appearance and manner and certain interesting facts concerning his life.

The relating of such occurrences will be most acceptable and may result in the publication later of material that would not otherwise see light. Such reminiscences may be of great value if recorded and the time to record them is now before they are forgotten or their possessors pass away.

The secretary would like to hear by letter from any one recounting items of historical value or interest or if they should happen to be in the neighborhood he would welcome a call during which their experiences can be dictated to his amanuensis. All of these accounts will be carefully catalogued and placed in the research file for reference by any one who can make proper use of them. They will eventually go for permanent preservation to the National Museum which will be part of the Smithsonian Institution at Washington.

H. F. J. PORTER,
Secretary

NATIONAL MUSEUM OF
ENGINEERING AND INDUSTRY

LECTURES ON EVOLUTION AT THE CALIFORNIA INSTITUTE OF TECHNOLOGY

THE chapter of Sigma Xi of the California Institute of Technology and of Mount Wilson Observatory announces that there will be given under its auspices during the present year a course of lectures on evolution in its broader aspects. The provisional program is given below. The lectures will be given in Culbertson hall at the institute at 8 o'clock on alternate Thursday evenings.

January 21. *Radiation and Spectroscopy:* DR. R. A. MILLIKAN, professor of physics at the California Institute.

February 4. *Structure of the Universe:* PROFESSOR F. H. SEARS, Mount Wilson Observatory.

February 18. *Nebulæ:* DR. E. P. HUBBLE, Mount Wilson Observatory.

March 4. *The Solar System:* DR. C. E. ST. JOHN, Mount Wilson Observatory.

March 18. *Some Phases of the Evolution of Man:* DR. J. C. MERRIAM, president, Carnegie Institution of Washington.

April 1. *Geological History of the Earth:* DR. J. P. BUWALDA, professor of geology, California Institute.

April 15. *Geological History of the Earth:* DR. J. P. BUWALDA, professor of geology, California Institute.

April 29. *Evolution of Matter and Energy:* DR. R. C. TOLMAN, professor of physical chemistry and mathematical physics, California Institute.

May 12. *Evolution of Stars:* DR. H. N. RUSSELL, professor of astronomy, Princeton University.

Octoebr 14. *The Earth and the Sun:* DR. C. G. ABBOT, Smithsonian Institution.

November 4. *Evolution of Life on the Earth:* DR. CHESTER STOCK, professor of paleontology, California Institute.

November 18. *Evolution of Life on the Earth:* DR. CHESTER STOCK, professor of paleontology, California Institute.

It is hoped that the course may be continued through the year 1927 so as to include lectures on biological evolution, anthropological evolution, the development of early civilizations and the evolution of mind and of human thought.

SCIENTIFIC NOTES AND NEWS

WILLIAM BATESON, director of the John Innes Horticultural Institution, near London, distinguished for his contributions to genetics and other biological subjects, died on February 1 in his sixty-fifth year.

PROFESSOR ROBERT H. MILLIKAN, director of the Norman Bridge Laboratory of Physics at the California Institute of Technology, has been elected a corresponding member of the French Academy of Sciences (section of physics) to take the place of the late Sir James Dewar.

PROFESSOR CHARLES JOSEPH CHAMBERLAIN, of the University of Chicago, has been elected a corresponding member of the Botanical Society of Geneva.

PROFESSOR E. D. MERRILL, dean of the College of Agriculture and director of the Agricultural Experiment Station of the University of California, has been elected a corresponding member of the Deutschen Botanischen Gesellschaft, in recognition of his "great and permanent service in the elucidation of the flora of tropical Asia, especially of the Malay Archipelago."

DR. J. WHITRIDGE WILLIAMS, professor of obstetrics in the Johns Hopkins University, recently received word of his election as an honorary member of the Society of Obstetrics and Gynecology of Paris.

DR. OSKAR VON MILLER, of the German Museum of Natural Sciences at Munich, has been made a corresponding member of the Royal Academy of Sciences of Stockholm.

S. Z. DE FERRANTI, inventor and engineer, has been made an honorary member of the British Institution of Electrical Engineers.

DR. HARRY PLOTZ, of the Pasteur Institute, Paris, was recently made a chevalier of the Legion of Honor by the French government.

DR. P. VOLKMANN, emeritus professor of theoretical physics at the University of Königsberg, celebrated his seventieth birthday on January 12.

PROFESSOR BAR has been elected president of the French Academy of Medicine and Professor Gley vice-president.

SIR OLIVER LODGE has been elected president of the Radio Society of Great Britain for 1926.

PROFESSOR DEXTER S. KIMBALL, dean of the college of engineering at Cornell University, has been elected president of the American Engineering Council, in succession to James Hartness.

PROFESSOR MARSTON T. BOGERT, of the department of organic chemistry at Columbia University, has been appointed a research consultant in the Chemical Warfare Service.

DR. CLARENCE C. LITTLE, president of the University of Michigan, has accepted the chairmanship of the lay advisory board of the American Association for Medical Progress, Inc.

AT the close of ten years' service as managing editor of *Genetics*, Dr. George H. Shull has at his own request been relieved and Dr. Donald F. Jones, of the Connecticut Agricultural Experiment Station, New Haven, has been elected to the managing editorship.

A. W. ALLEN has resigned as editorial representative of *Chemical and Metallurgical Engineering* in the Pacific Coast region, to join the technical staff of Antony Gibbs and Co., in connection with the operation of nitrate recovery plants in Chile. He will sail for Chile late in February.

DR. ALBERT F. WOODS, president of the Maryland State University, is to be appointed director of scientific work in the United States Department of Agriculture by Dr. W. M. Jardine, Secretary of Agriculture, to fill the vacancy caused by the resignation of Dr. E. D. Ball.

DR. F. W. MILLER, formerly of the Oregon Agricultural College, has been appointed veterinarian and physiologist in the U. S. Bureau of Dairying.

DR. B. H. HAGER, associate professor of surgery at the University of Wisconsin, has received an appointment at the Mayo Clinic, Rochester.

HARRY B. RIFFENBURG has resigned as chemist in the Quality of Water Division of the U. S. Geological Survey to accept a place as chemical engineer with the Western Electric Company, Hawthorne Station, Chicago.

DR. AND MRS. N. L. BRITTON, of the New York Botanical Garden, arrived in San Juan on January 25, planning to devote two months or more to a continuation of their studies of the flora of Porto Rico. Dr. H. A. Gleason, curator of the New York Botanical Garden, went a week earlier to Porto Rico, where he will undertake an ecological survey of the island in collaboration with Dr. Mel T. Cook, of the Insular Experiment Station. It is planned to publish the results of this survey as a part of the scientific survey of Porto Rico and the Virgin Islands, inaugurated by the New York Academy of Sciences and affiliated institutions in 1913. During the absence of Dr. Britton, Dr. Marshall A. Howe is acting director of the botanical garden.

PROFESSOR GORDON F. FERRIS, of the department of entomology of Stanford University, has returned to the university with a collection of plants and insects from Tres Marias, a group of islands off the west coast of Mexico.

DR. RAYMOND C. SHANNON, of the U. S. Bureau of Entomology, left for Buenos Aires on January 30, where he is going to study the mosquitoes of the region under the auspices of the Argentina government.

DR. WILLIAM DARRACH, dean, College of Physicians and Surgeons of Columbia University, New York, recently went to San Juan, Porto Rico, in connection with the School of Tropical Medicine of Columbia University.

DR. PAUL F. GAEHR, of Wells College, is spending the second semester on leave of absence in study at Harvard University. His place is being filled by Professor C. C. Kiplinger.

DR. EDWARD ELLERY, dean of the faculty of Union College, Schenectady, N. Y., who is at present on a visit to England, recently visited the Universities of St. Andrews and Aberdeen, where he delivered an address on the "Universities of America."

DR. ALFRED NEWTON RICHARDS, professor of pharmacology at the University of Pennsylvania, will give a series of four lectures under the auspices of the Herter Foundation at the University and Bellevue Hospital Medical College, beginning on February 15 at four o'clock and continuing daily at the same hour. The lectures will be on the subject of "The Physiology and Pharmacology of the Kidney."

DR. GEORGE E. VINCENT, president of the Rockefeller Foundation, gave one of the Cutter lectures in preventive medicine at the Harvard Medical School on February 11 entitled "Every Doctor a Health Officer."

DURING the latter half of January, Professor W. M. Davis conducted a special seminar in physiography in the department of geology of Stanford University, California. At the meeting of the Cordilleran section of the Geological Society of America held at Stanford University on January 30 he gave an address on "The Basin Range Problem."

PROFESSOR JAMES F. KEMP, of the department of geology at Columbia University, gave an address before the Geological Society of Boston, meeting at the Massachusetts Institute of Technology on February 9.

DR. DOUGLAS W. JOHNSON, professor of physiography in Columbia University, gave an illustrated lecture on "The Shore-Line Scenery of the Atlantic Coast" at Cornell University on January 21.

DR. VICTOR C. VAUGHAN gave a lecture on "The Typhoid Fever Board of the Spanish War" at the Army Medical School on January 29.

ON January 23, Dr. C. A. Chant, professor of astro-physics in the University of Toronto, delivered an address to the Royal Canadian Institute on the subject "Some Astronomical Problems, including the Surface Temperature of the Planet Mars."

DR. BURT L. NEWKIRK, research engineer of the General Electric Company, made a lecture tour into the North Central region last December. He spoke on "Shaft Behavior" before students in the engineering schools of the Universities of Illinois, Minnesota, Ohio, Wisconsin and of Purdue University; on "The Mercury Turbine" before the electrical board of trade of St. Louis, and on "Engineering Research" before the Affiliated Engineering Societies of that city.

F. L. RANSOME, professor of economic geology at the University of Arizona, will give a course of lectures at Stanford University in April or May.

DR. R. K. NABOURS, head of the department of zoology at the Kansas State Agricultural College, delivered a lecture entitled "A Quarter Century of the New Biology" before the chapter of Sigma Xi at the University of Kansas on January 28.

DR. CHARLES J. FISH, oceanographer with the *Arcturus* expedition to the Sargasso Sea and Galapagos last year, spoke before the Brown chapter of the Society of Sigma Xi in Providence on January 29 on "The Cruise of the *Arcturus*."

THE centenary of the birth of the physiologist, Felix Hoppe-Seyler, was recently celebrated in the physiological institute of Tübingen University.

ONE of the principal streets in Valencia has been renamed after the celebrated histologist, S. Ramón y Cajal.

PROFESSOR WILLIAM A. STOCKING, formerly head of the dairy department of the New York State College of Agriculture at Cornell University and at one time dean of the college, died on February 3, aged fifty-four years. Professor Stocking was born in Simsbury, Conn., in 1872.

DR. MURRAY GALT MOTTER, formerly professor of physiology at Georgetown University School of Medicine, died on January 14, aged fifty-nine years.

JOHN TATLOCK, of New York City, died on January 3 at the age of sixty-six years. He was associate astronomer at the University of Wisconsin in 1883–84 and professor of astronomy at Beloit College, Beloit, Wisconsin, in 1884–85.

ROBERT HENRY CAMPBELL, until recently director of forestry in the Canadian department of the interior, has died at the age of fifty-nine years.

DR. C. GESSARD, of the Pasteur Institute, Paris, who isolated a pyocyanic bacillus from pus in 1882 and was also known for his work on oxydases, has died.

PROFESSOR ALFRED PEROT, professor of physics in the École Polytechnique, Paris, and president of the Commission de Métrologie, died on November 27, aged sixty-two years.

PROFESSOR MATTHEW CURRY, formerly professor of engineering at King's College, London, died on December 29, aged seventy-four years.

DR. CLAUDE DU BOIS-REYMOND, professor of ophthalmology at the University of Berlin and son of the distinguished physiologist, Professor Emil du Bois-Reymond, died recently at the age of seventy years.

A COMMITTEE consisting of Drs. M. C. Hall and E. B. Cram, of the Department of Agriculture; C. W. Stiles, of the Public Health Service; H. J. Nichols, of the Army Medical Corps, and W. W. Cort, of the Johns Hopkins University, has been considering a proposal to establish a memorial to the late Dr. Brayton H. Ransom, who at the time of his death was chief of the zoological division of the Bureau of Animal Industry, and who ranked as one of the foremost parasitologists. The several propositions which are being considered are as follows: a tablet or a painting to be put up in the Department of Agriculture or a medal or a money prize to be awarded for important contributions in medical zoology. The final decision will depend on the amount subscribed. The subscriptions may be sent to the secretary of the committee, Dr. Eloise B. Cram, Bureau of Animal Industry, Department of Agriculture, together with suggestions as to the nature of the memorial.

THE United States Civil Service Commission announces an open competitive examination for associate cereal chemist to fill vacancies in the U. S. Bureau of Chemistry, at an entrance salary of $3,000. Receipt of applications will close on March 16.

THE sixth summer term of the American School of Prehistoric Research will open in London on June 25, 1926. In the course of the summer, work will be carried on in France, Spain, Switzerland and Belgium, including actual experience in digging at a number of sites in these various countries. The three-months summer term of 1925 was so arranged as to give students actual contact with every phase of prehistoric culture from Eolithic through Paleolithic, Neolithic, Bronze and Iron. Approximately one third of the time was spent in excavating at various sites. Seventy-seven sites in all were inspected, and studies of special collections were carried on in forty-four museums. Of the eighty-eight conferences arranged, thirty were given by the director and fifty-eight by forty-two different European specialists. The American School of Prehistoric Research is the only organization claiming the Old World as its field of activity which is sponsored by the Archeological Institute of America and the American Anthropological Association. Particulars may be obtained from Dr. George Grant MacCurdy, director of the American School of Prehistoric Research, Peabody Museum, Yale University, until March 1, and after that date from Dr. Aleš Hrdlička, U. S. National Museum.

THE zoology club of the State University of Iowa is sponsoring at the present a series of lectures on the subject of evolution. These lectures are presented by professors of the natural science departments of the university and they are open to the public. The first lecture was given by Professor C. C. Nutting, of the department of zoology, on January 8 on the subject "The General Arguments for Natural Selection," the second on January 22 by Professor G. L. Houser on the subject "Evolution in the Light of Life Histories and Cellular Organization of Animals" and the third of the series on February 5 by Professor A. O.

Thomas, of the department of geology, on "Paleontological Evidences of Evolution." The remaining two lectures will be given by Professor R. B. Wylie, of the department of botany, on "Some Evidences of Plant Evolution" on February 19 and Dean G. F. Kay, of the department of geology, on "The Place of Man in the Universe" on March 12.

THE Sigma Xi Alumni Association of the University of Pittsburgh held an open meeting on January 28. The program was presented by the department of zoology as follows: "Studies in Biometry, White Spotting in Rabbits, Undescribed Color Varieties in Rabbits," Professor H. D. Fish; "Fresh Water Life in Cumberland Region," Dr. A. E. Ortmann; "Ontogenetic and Phylogenetic Development of Soldier Caste of Termites," Dr. A. E. Emerson; "Pattern Regulation in Vermillion-spotted Newt, *Triturus Viridescens*," by H. H. Collins.

A SIGMA XI club has been formed at the University of South Dakota with Dr. Freeman Ward as president and Dr. E. P. Churchill as secretary. Monthly meetings have been held during the year at which the following topics have been presented: "Gravel Prospecting in South Dakota," by Dr. E. P. Rothrock and Professor H. V. Newcomb; "The Hibernation and Seasonal History of Dandelion Powdery Mildew," by Dr. H. C. Abbott, and "The Effect of Alkali upon Pepsin," by Professor Grant Kloster. Other topics will receive attention during the rest of the year.

ON the evening of February 17, the members of the Columbia University chapter of Sigma Xi will be the guests of the scientific staff of the American Museum of Natural History, for an inspection of their research laboratories, accompanied by brief accounts of different branches of research being conducted therein. An opportunity will be afforded to inspect some of the most important discoveries of the third Asiatic expedition.

LUCIAN N. LITTAUER, of Gloversville, has pledged $10,000 a year for an indefinite period to the school of public health of New York University to be used in studying pneumonia.

AMONG recent gifts to the University of Chicago is one from Mr. Reuben H. Donnelley of $1,500 a year for the next three years, 1926–27–28, for a scholarship in the department of physiology under Dr. A. J. Carlson, to be known as the Laura Thorne Donnelley Scholarship. The university has also received a gift of a series of transections of the eye, a collection of great value from the standpoint of comparative anatomy, from Professor Doctor O. Schnaudigel, director of the Universitäte-Augenklinik, Frankfurt, Germany.

THE Rockefeller Foundation has recently made a donation of three million francs to the Faculty of Medicine of Strasbourg. One million of this sum is to be used for building an otolaryngologic clinic; the second million is for building an institute of histology; the third million is to subsidize research workers.

A GIFT of £10,000, which, for the time being, is anonymous, has been made to the appeal fund, started by Lord Balfour in November, to promote the work of the National Institute of Industrial Psychology, England. The first list of subscriptions has not yet been issued. It will include 100 guineas from the National Union of Railwaymen and 1,000 guineas from Messrs. Debenham's.

SANCTION has been given by the standing Finance Committee for the ultimate expenditure of £833,000 on the Forest Research Institute at Dehra Dun, India. This marks an important step in India's progress. It is an old complaint of Indian aspirants to the higher posts of the forest department that hitherto the expenses of European training placed them at a disability. To this it was generally replied that the required standard was unattainable in India. The government's decision will bring the institute thoroughly up to date and enable Indians to qualify for forestry positions.

THERE has been presented to the natural history department of the Royal Scottish Museum by Lady McEacharn, Galloway House, Garlieston, and Captain N. McEacharn, an extensive collection of Australian birds and their eggs, made by the late Sir Malcolm McEacharn during his residence in Australia. The series of mounted birds, which includes over 350 individuals, is specially rich in birds of paradise—among which are included several rare species—in bower-birds, in parrots and in parakeets. The cabinet of birds' eggs, with over 1,500 specimens, the majority in clutches, is representative of 570 different species. In addition to birds and birds' eggs, Sir Malcolm McEacharn's collection contained many zoological specimens in alcohol, among which the most interesting are a large series of the embryonic and post-embryonic stages of marsupials, as well as fishes and invertebrate animals collected on the shores of Australia or among the islands of the East Indian Archipelago.

WE learn from *Nature* that the New South Wales government has announced its decision to close the State Observatory, which for many years has been under the control of Professor W. E. Cooke. Owing to the growth of Sydney, the site of the observatory has become quite unsatisfactory and its work has suffered in consequence. The necessity for removal to a distant suburb has repeatedly been urged upon successive state governments, but the Labor Ministry's

method of dealing with the problem has come as a surprise.

AN exhibition organized by the chief scientific board of Russia is soon to be opened at Moscow, which will demonstrate the researches and achievements of the different scientific institutions in Russia. Exhibits will be furnished by the Baring Sea Hydrological Expedition, by the Polar Expedition, by the Timiryazev Research Institute, by the Roentgen Institute, etc. Professor B. M. Zavadovsky will exhibit his experiments on the physiology of the thyroid gland of birds and animals. A number of charts and drawings will be displayed by the Optical and Radio Institutes. New instruments and appliances will be exhibited by the Astrophysical and Geophysical Institutes. There is also to be displayed a variety of objects of ethnographical interest.

THE *Christian Science Monitor* states that King Haakon, of Norway, on January 29 honored the members of the *Maud* expedition by conferring on them the Order of Saint Olav. After eight years' absence, Captain Wisting will remain in Norway a few days, then proceed to Rome to participate in Captain Roald Amundsen's transpolar flight. Dr. Sverdrup, scientific member of the expedition, has been offered a professorship in the University of Oslo.

UNIVERSITY AND EDUCATIONAL NOTES

THE daily papers report that more than $7,000,000 has been pledged to the University of Miami by residents of Greater Miami, in a campaign started to raise $10,000,000 for buildings and equipment. Construction of administration buildings has started and it is planned to open the university in October.

DR. CLARENCE C. LITTLE, president of the University of Michigan and former president of the University of Maine, will direct the summer course in biology at the University of Maine biological station at Bar Harbor this year.

DR. ALBERT DAVIS MEAD, director of the department of biology at Brown University, has been made vice-president of the university to act under the direction of President W. H. P. Faunce.

DR. ELMER P. KOHLER, professor of chemistry at Harvard University, has been appointed acting dean of the graduate school of arts and sciences for the second half of the current academic year, during the absence of Dean George H. Chase.

DR. BARTON WARREN EVERMANN, director of the museum of the California Academy of Sciences and of the Steinhardt Aquarium, has been appointed lecturer in zoology at Stanford University. He has also been reappointed chairman of the section on scientific research of the Commonwealth Club of California, which position he has held for several years.

JAMES ASTON, of Pittsburgh, for the past five years metallurgical engineer in charge of research with the A. M. Byers Company, has been appointed professor of mining and metallurgy and head of the department of mining and metallurgical engineering at the Carnegie Institute of Technology.

DR. S. J. BARNETT, research associate of the Carnegie Institution of Washington, has been appointed lecturer in physics at the University of California Southern Branch, for the second half of the current academic year.

DR. CHARLES L. BONIFIELD has been made director of the gynecologic service in the medical school at the University of Cincinnati to succeed the late Dr. Sigmar Stark.

M. GIGNOUX, professor of geology at the University of Strasbourg, has been appointed professor of geology and mineralogy at the University of Grenoble to take the place of the late Professor Kilian.

DISCUSSION AND CORRESPONDENCE

THE DANGER OF EARTHQUAKES IN NEW ENGLAND

IN the November twentieth number of SCIENCE is an article entitled "Jay Backus Woodworth" in which the statement was made that it was his opinion "that neither human history nor the relevant facts of geology indicate serious danger for the city of Boston from earthquakes."

This is not in accord with his published statements as quoted below:[1]

> The belief is quite general about Boston that this region is now practically exempt from severe earthquakes, and that the occurrences of the 17th and 18th centuries at Plymouth, Newbury, and Boston pertain to an exhausted régime in the earth's conduct. It is well to remember, however, that from the great earthquake of 1638, felt at Plymouth, to the shocks at Newbury in 1727 is an interval of 89 years; and that the interval between the earthquake of 1638 at Plymouth and that of 1755 at Boston is 117 years. The interval between the earthquake of 1755 at Boston and the Charleston earthquake of 1886 is 131 years. These long intervals of repose and minimum seismic action lull suspicions and cause the multitude to regard what has not occurred in their father's and grandfather's days as a possibility too remote to enter into their own lives. Nevertheless it behooves us to remember that the earthquake at Plymouth, Mass., in 1638, at Newbury, Mass., in 1727, at Boston in 1744 and more strikingly in 1755, and yet more impressively at Charleston, South Carolina in 1886, and at San Francisco in 1906, offer phenomena during

[1] Harvard Seismographic Station, Seventh Annual Report, including Records 1 January to 31 December, 1915.

more than three centuries, the time of occupation of the middle latitudes of the North American continent by European peoples, of the magnitude of the local play of the seismic force. It is evident that the intervals between epochs of great destructive force in the same locality are to be measured in centuries and fractions of a century. Until science shall have discovered the signs of the return of these alarming and often disastrous earthquakes, we can only bear in mind that as we recede in the steady march of time from the epoch of one of these events we draw nearer, step by step, to the next one in the series.

Also in the Harvard Seismographic Station Fourth Annual Report for the year, 1 August, 1911–31 July, 1912 Professor Woodworth states as follows:

The importance of engineers and architects taking into account the liability of earthquake shock strong enough to damage buildings in this district is amply shown by the history of earthquakes at Plymouth, Newburyport and Boston in the 17th and 18th centuries. There can be little doubt that the recurrence of such shocks as were felt in Boston in 1755 would produce much damage. While the Atlantic coast of the continent is relatively immune from earthquakes, the case of Charleston in 1886 enforces attention upon the necessity of recognizing the risk of destructive shocks upon this coast at long intervals perhaps of a few centuries only. Sane precaution demands the avoidance of the mistake made at San Francisco of placing a public reservoir upon a fault zone of recent movement, and of the folly of cheap mortar and rubly masonry which together were factors of first importance in the loss of life and property in Charleston in 1886, and in Messina in 1908. We may not be able to avoid building our houses and public edifices upon ground liable to destructive shocks, but we have abundant information as to how these structures should be built in order to reduce the risks of demolition to a minimum.

In many long conferences with me Professor Woodworth frequently expressed the opinions quoted above and went into detail about the great disaster which might befall the less stable sections of the city in an earthquake such as Boston has experienced in the past. To my personal knowledge he held these views up to the time of his final illness.

I feel that on such an important matter his opinions should be correctly stated.

IRVING B. CROSBY
JAMAICA PLAIN, MASS.

A PLEA FOR THE RETENTION OF THE TERM "BIOS"

IN the nomenclature of the vitamins suggested by Funk[1] it is proposed to change the name "bios" to vitamin D. Several reasons why the original name for the "substance indispensable for the development of yeast" should be retained occur to one concerned primarily with the "bios problem."

First: The substance which affects the multiplication of yeast cells was reported by Wildiers in 1901, ten years before the vitamins were recognized. The designation suggested at that time was "bios," with the further suggestion that it should be used until the substance could be identified chemically.

Second: No advance towards the chemical identification of "bios" has been made by its classification with the vitamins.

Third: It is questionable whether "bios" is a vitamin in the generally accepted sense of that term.

Fourth: The literature of "bios" has grown to considerable proportions since 1901. A recent review[2] listed 144 papers by more than 80 authors. It is evident that "bios" has a well-established literature of its own which would appear under that subject heading and not under vitamin D.

In view of these facts it would seem most unfortunate and confusing to rename the "bios" of Wildiers until its identity shall have been established.

MARGARET B. MACDONALD
UNIVERSITY OF TENNESSEE
AGRICULTURAL EXPERIMENT STATION

A FEW SUGGESTIONS REGARDING REPRINTS

EVERY one must have been perplexed by the difficulty of storing reprints so that they may be readily available. Current specimens range from vest-pocket to large portfolio size, even excluding monographs, which must be omitted from my criticisms for self-evident reasons. This wide range in size makes it difficult to make proper provision for their storage, not only in private but also in public libraries. This can not be accomplished without much loss of space, and one often is distressed by the wear an important reprint has received, largely due to improper storage.

One could, to be sure, classify reprints according to size, but that is inconvenient for other reasons and equally objectionable from the standpoint of space. Some publishers and institutions have already adopted a uniform size, but much remains to be desired for the great variation in size confronts one not only in the storing but also in the binding, even if done in temporary holders, and in the mailing of reprints.

Not infrequently the name, date and volume of the publication from which the reprint is taken are not indicated on it by the publisher. Besides depriving the journal in question of proper credit for the article this omission makes ready reference impossible. Rarely, publishers also use an inferior

[1] SCIENCE, (62), 157, 1925.

[2] Tanner, F. W., *Chemical Review* (1), 397, 1925.

grade of paper for reprints, without consulting the author, in consequence of which illustrations may suffer very seriously in the reproduction.

I am not sufficiently familiar with paper to be able to suggest the most economical size of reprint from that standpoint, but I hope that publishers of scientific literature will some day be able to adopt more uniform sizes, for in this case standardization not only will effect economy in time and materials but it will also greatly extend the life of reprints. I am certain that others than myself will be duly grateful for this change.

A. W. MEYER

STANFORD UNIVERSITY

SCIENTIFIC RESEARCH IN THE UNITED STATES

A GROUP of distinguished scientific men and publicists, under the auspices of the National Academy of Sciences, has formed itself into a board of trustees of a National Research Endowment, and plans to raise a large fund for the encouragement of research in pure science. We are all in agreement in regard to the fundamental place of research in our civilization and the need of every effort to facilitate the work of those qualified to contribute to the advancement of science. I venture, however, to question the wisdom and the truth of the implication of the first declaration made by the board, as printed in last week's issue of SCIENCE, which reads:

> The Trustees of the National Research Endowment, recognizing that human progress depends in large degree upon research in pure science, declare their conviction:
>
> (1) That the United States, which already occupies a leading position in industrial research, should rank with the most enlightened nations in the advancement of pure science.

This follows the reecnt statement by Secretary Hoover, who is chairman of the new board, to the effect that the United States is behind most European nations in its contributions to pure science. It appears to a psychologist to be better policy to tell people from whom money is wanted of what we have accomplished, rather than to complain that we are behind other nations, even if this were true. What evidence is there for its truth?

While a nation such as Holland is contributing more to science in proportion to its population and wealth than the United States, Great Britain or Germany, these three nations are far in advance of any others in their total productivity. It is my general impression, which may or may not have more validity than the assumption of Secretary Hoover and the distinguished board of the National Research Endowment, that the United States is in advance of Great Britain and Germany in the biological and geological sciences and in astronomy, behind them in physics, chemistry and physiology, about on even terms with them in mathematics and the medical sciences.

In the case of psychology some evidence can be adduced. Counting up the reviews in the first twenty-five volumes of the *Zeitschrift für Psychologie*, I found that the United States led all nations in the number of contributions to experimental psychology, selected by the Germans as most worthy of review, exceeding Great Britain in a ratio of ten to one. "Who's Who in Science," published in Great Britain in 1913, attributed 84 of the world's leading psychologists to the United States, as compared with 31 to Germany, 27 to England and 13 to France. Since then the number of psychological workers of the United States has about doubled; the number in Germany and Great Britain has remained nearly stationary. The work in France and Italy has regressed. If it is said that we may do more work, but that it is not outstanding in character, then I ask for the name of a foreign psychologist comparable in genius to William James. There is none except Francis Galton, who is not usually regarded as a psychologist.

I venture also to question the validity of the distinction made by the trustees of the National Research Endowment between "industrial research" and "the advancement of pure science." Research in the industrial laboratories may make fundamental contributions to constructive science; a university doctorate dissertation may be nearly as trivial as the score in a game of golf.

We ought certainly to obtain scientific information on these subjects; it would be desirable to spend a minute part of the fifty million dollars that the board proposes to collect in determining whether the first statements that it makes are correct.

J. MCKEEN CATTELL

QUOTATIONS

THE TORCH OF PURE SCIENCE

MR. HOOVER touched an important truth when he told our mechanical engineers recently that pure science receives shamefully meager support compared with applied science, and that the National Academy of Sciences could not undertake a better crusade than its present effort to raise money to restore the balance. We spend large federal appropriations for research in agriculture and technology. We establish rich foundations, like the Rockefeller Institute, for practical inquiry. Business is endowing laboratories, like those of the General Electric and the du Ponts, of unprecedented size. Our university scientists are expected, in the intervals of grading papers, to pro-

duce something that pays. In this lop-sided scientific development there is a heavy spiritual and intellectual loss.

It is true, as Mr. Hoover says, that there is also a practical loss. The pure science of to-day is changed into the practical science of to-morrow. The discovery of the Hertzian rays was pure science, but it gave us Marconi's wireless. Becquerel's discovery of radioactivity was pure science, but to-day every large hospital has its radium tubes. Present-day studies in photosynthesis are academic, yet if we ever manufacture carbohydrates synthetically it will be upon the basis of such studies. The great principles of pure science, like Mendel's laws and Dalton's atomic theory, have been keys to unlock whole treasure-houses of practical advantages. As yet the United States has produced few men eminent in this field. Of nearly fifty Nobel prize winners in chemistry and physics but two have been Americans.

The best argument for pure science, however, takes little account of its value in dollars. A nation that pours out billions on movies, chewing-gum, radios and automobiles can afford to endow the search after truth for truth's sake more generously. We should feel a sufficient interest in the widening of the bounds of the human mind to give such a search both more applause and more support. Pure science insists upon the pursuit of wholly disinterested objects; upon sincere and fearless work; upon only one standard—the highest standard. These are aims which America emphasizes all too little for its moral and intellectual good.– *The World,* New York.

SCIENTIFIC BOOKS

Traité de Géographie Physique. Tome Premier, Notions Générales—Climat—Hydrographie. Quatrième édition. pp. xii, 496. EMMANUEL DE MARTONNE. Librairie Armand Colin, Paris. 1925.

ABOUT sixteen years ago Emmanuel de Martonne, professor of geography at the Sorbonne, published the first edition of his well-known treatise on physical geography, a single volume of 910 pages. To-day the fourth edition of this work is appearing in three volumes, largely rewritten and greatly increased in size, in response to the insistent demand that more and more knowledge be covered by that pancosmic subject.

The book begins with the pertinent question: What is geography? The reply, covering twenty-five pages, with twenty-eight references to eminent authorities, discusses the growth of that knowledge called geographical, and the evolution of its treatment from the days of Homer, stage by stage, to the very present.

For a long while, a time that some of us still remember, geography was the naming of capitals and the bounding of countries, but to-day it is, at least, the distribution over the face of the earth of all phenomena, physical and biological; how they got where they are, and their relations to each other. Clearly, therefore, a real up-to-date geographer must be master of many subjects and Jack of all the rest. I once remarked to an eminent professor of this science that according to this modern concept one might teach even theology as a branch of geography, and his instant reply was: "I do, I do. Religion affects human distribution, and religion involves theology, which therefore I must teach."

The next seventy-five pages are given in approximately equal parts to astronomy, map projections and geophysics. This is followed by an account, covering 225 pages, of the climates of all parts of the earth. The rest of this first volume discusses oceans, lakes and rivers, and the phenomena connected with them.

Every page is clearly written and interesting, but, however urgent the need, there is no trace of mathemathics anywhere, save one very short equation, on page 160, in which the symbol signifying the angular speed of terrestrial rotation, by some curious slip, is called gravity acceleration. This absence of all mathematics is, perhaps, necessary for the average student of geography, but if so, more is the pity, for in many places the subject is such that it can not be understood without resort to this powerful aid to clear thinking.

Professor Martonne's treatise has the exceptional merit of being so excellent as to deserve perpetuation and improvement. With this object in view, I shall, therefore, call attention to a few minor points that deserve, perhaps, a little further consideration:

On page 77, it is stated that a decrease of the carbon dioxide in the atmosphere by 55 to 67 per cent. would cause a lowering of the temperature of the air by 4° C. to 5° C., and a doubling of the carbon dioxide an increase of temperature by 7° C. to 8° C. Perhaps so, if carbon dioxide were the only absorbing element surrounding the earth, but with water vapor always present, and much more effective, the changes in temperature thus produced certainly would be far less. Water vapor leaves but little radiation for the carbon dioxide to absorb.

The explanation of the diurnal variations of pressure, as given on pages 172–173, is entirely inadequate. It also contains two slight errors in detail. The observations referred to were not by sounding balloons, as stated, but by kites; and the temperature wave was not over the sun, but at the surface of the earth.

On page 179 relative humidity is defined as the

extent to which the air can still take up water vapor. This, of course, is not relative humidity, but saturation deficit.

We are told on page 182 that the sudden conversion of cloud to rain may be caused by an electric discharge, and that this occurs in the thunderstorm. This idea, if ever seriously entertained, certainly has long been abandoned.

The worst slip in the book occurs on page 309, where it is stated that temperature decreases with altitude, because of the rarefaction of the air, whose heat capacity decreases with density. This is one of several entirely erroneous explanations various people have given of this well-known phenomenon. Perhaps it might be in place to add also that its correct explanation—the assignment of the causes (convection, expansion, radiation and absorption) that are both necessary and sufficient—seldom is found in any book or paper.

The drainage wind down valleys is erroneously explained on page 324 as being caused in substantially the same way as the land breeze, instead of by surface cooling.

It is stated on pages 393–394 that the temperature of the deeper portions of a near-inland sea is that of the bottom of the strait connecting it with the ocean. This, however, is not always true; it is not true, for instance, of the Red Sea. In fact the temperature of the abysmal waters is substantially that of the densest portion of the sea in the course of the year, as determined by salinity and temperature jointly.

An amusing error occurs on page 443, where it is stated that on the Dead Sea, density 1.166, an egg floats two thirds above the water. Perhaps some eggs do, but all such should be handled with the greatest care.

As implied above, these are only trifling slips in a work of great excellence. Some of us, accustomed to deductive reasoning, would enjoy a larger number of postulates and generalizations than occur in this work. They would shorten the reading and materially aid the memory. However, it is not plausible deductions, but established facts that Professor Martonne has given, and given exceedingly well.

W. J. HUMPHREYS

U. S. WEATHER BUREAU

SPECIAL ARTICLES

AN APPARENT CASE OF MONOCENTRIC MITOSIS IN SCIARA (DIPTERA)

MONOCENTRIC mitosis has long been known in the case of artificially treated eggs (sea urchins, etc.), where it frequently results from mechanical injury or exposure to chemicals.[1] The evidence from such sources indicates, as noted by Wilson (*l.c.*, p. 169) that the process is a pathological one. The only other record known to the writer, of anything approaching a monocentric mitosis is that of the peculiar mitotic figure found in the abortive first spermatocyte division of the hornet (*Vespa crabro*) as described by Meves and Duesberg.[2]

In the latter case, as in the former, the process differs essentially from typical mitosis in that no nuclear division and no distribution of chromosomes takes place.

While studying chromosome behavior in flies of the genus *Sciara* the writer has observed what appears to be a process of monocentric mitosis occurring as a normal and regular event at the primary spermatocyte division. This case, unlike those cited above, involves a division of both nucleus and cell and a definite and regular distribution of chromosomes to the daughter nuclei. The chromosomes do not divide at this division, and the cell divides unequally; but both of these features are found in other organisms where the spindle is bipolar, and neither is to be regarded as indicative of an abnormal or a pathological condition. Likewise, since this is the reduction division, lack of chromosome division does not involve later complications.

When this peculiar mitosis was first observed it was viewed as an abnormality, but a careful study has convinced the writer that it is a normal and constant mode of division of the primary spermatocytes in two and probably in many or all species of this genus. The two species studied most extensively thus far are *Sciara coprophila* Lint., and *S. similans* Joh.

The main characteristics of this division, of which a full account will appear later, are as follows:

(1) The chromosomes are univalent and diploid in number (a condition due, apparently, to the absence of synapsis).

(2) No aster or centrosome is visible, but spindle fibers are evident and all extend to one pole.

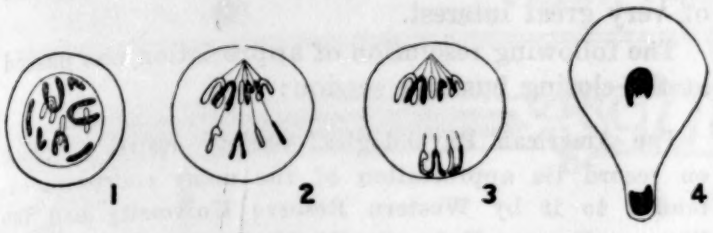
(3) All the chromosomes appear to be attached by spindle fibers to this pole.

[1] Boveri, Hertwig, etc. For general account see Wilson, E. B., "The Cell," Macmillan, New York, 1925, pp. 168–192.

[2] 1908. "Die Spermatocytenteilungen bei der Hornisse." Arch. f. Mik. Anat. 71: 571–587. It should be noted that in the related species, *Vespa maculata*, Mark and Copeland (1907. Proc. Amer. Ac. Arts Sci. 43: 71–74) describe a bipolar spindle at this division, which suggests that the observations of Meves and Duesberg should be verified.

(4) No equatorial plate is formed, the chromosomes passing from their prophase positions directly on their anaphase course.

(5) The chromosomes do not divide, but are segregated bodily into two groups.



FIGS. 1–4. Diagrams representing, respectively, the prophase, early and late anaphase and telophase of the primary spermatocyte division in *Sciara coprophila*. In another species, *Sciara similans*, the two hook- or J-shaped chromosomes are replaced by V's. Actually, of course, the chromosomes lie at different levels in the cell. This is indicated very imperfectly in the figures by drawing those at a low level in outline and the others in solid black. It will be noticed that each of the four chromosomes going away from the visible pole has a counterpart or "mate" going toward the pole. The remaining two chromosomes (at the left in figures 2 and 3) are larger than any of the others, and both go regularly to the visible pole.

(6) An unequal distribution is effected, six chromosomes passing to the visible pole[3] and four going in the opposite direction. This segregation is a selective, accurate and regular process.

(7) Those going to the pole follow a convergent path and show the characteristics typical of anaphase chromosomes.

(8) The four going away from this pole are more elongate and are characteristically different in appearance from the others.

(9) They are irregularly placed in the cell and follow divergent instead of convergent paths. Like the other chromosomes they move along radii from the visible pole, but instead of approaching the pole they pass directly away from it (Figs. 2 and 3).

(10) The point of spindle fiber attachment of these four chromosomes appears to be normal—certainly it is in the case of the V-shaped ones, which are attached at the apex. But this point is posterior instead of anterior, and the chromosomes (at least the V-shaped ones) move backwards.

(11) The anterior ends of these chromosomes appear to lie free and show no indication of traction, while the posterior ends, to which the spindle fibers are attached, are usually taut and slender as if under tension.

(12) These four chromosomes continue to follow divergent paths until they approach the periphery of the cell, where their course is deflected and becomes convergent, ultimately bringing them together at a point opposite the visible pole.

[3] For an account of spermatogenesis in these flies see Metz, 1925, SCIENCE 61: 212, and papers in press.

(13) Subsequently an evagination occurs at this point and a very unequal cell division occurs, resembling the polar body formation of an egg (Fig. 4).

It will be noticed from this summary that asters and centrosomes are not visible in these cells, and hence that the mitotic figure is not known to be strictly of the monaster type. It is possible—although the evidence is all against the view—that an inconspicuous aster is present on the side opposite the visible pole. If so, the movement of the chromosomes seems to be independent of it. The feature of primary interest is that the spindle is clearly unipolar and all the chromosomes are "attached" by spindle fibers to this pole, even though some of them move away from it instead of toward it.

Those which move toward it exhibit the ordinary characteristics of behavior, while those which move away from it are reversed and otherwise give clear indications of being subject to a pulling or retarding force acting in the direction of the pole.

Without attempting a detailed discussion of the mechanics of this division it may be noted that to the writer the figures give convincing evidence of the presence of two forces acting in opposite directions, the one, represented by the spindle fibers, "pulling" toward the pole as just mentioned, the other, indicated by the movement of the four chromosomes, acting in the opposite direction and carrying these particular chromosomes bodily away from this pole. These chromosomes look as if they were anchored by flexible fibers to the pole and yet were being carried away from it by a radiating current. This is, of course, a purely descriptive statement, and not intended to suggest that such a current is actually present. The behavior of the chromosomes makes it more probable that the spindle fibers represent currents (as appears to be generally true of the astral rays, from the work of numerous observers) while the opposing force is of a different nature, possibly electrical (R. S. Lillie, and others). On the latter view the six chromosomes going to the visible pole would have the opposite electrical charge from the others, so that on them the action of the two forces would be coincident instead of antagonistic.

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SOCIETIES AND ACADEMIES

THE AMERICAN PHYSIOLOGICAL SOCIETY

THE thirty-eighth annual meeting of the American Physiological Society was held on December 28, 29 and 30 at the Western Reserve University School of Medicine, Cleveland, Ohio. The attendance was